Integrated Rate Law Review and Half Life

1. Match the correct equation with the reaction order by writing zero, first, or second in each blank.

$\frac{1}{[A]_t} - \frac{1}{[A]_o} = kt$ _____

$[A]_t - [A]_o = -kt$ _____

$\ln[A]_t - \ln[A]_o = -kt$ _____

$t_{1/2} = \frac{[A]_o}{2k}$ _____

$t_{1/2} = \frac{1}{k[A]_o}$ _____

$t_{1/2} = \frac{0.693}{k}$ _____

2. Write the first order integrated rate law in its "division" form.

3. Rearrange the integrated rate laws into equations for a line: $y = mx + b$.
For each reaction order, identify what type of plot (y vs x) will give a straight line, and identify what the slope of the resulting line corresponds to.

	y vs x		slope
zero			
first			
second			

4. Identify whether each of the following statements about half-lives refers to zero, first, and/or second order reactions.

_____ $t_{1/2}$ is constant during a rxn.

_____ $t_{1/2}$ varies during a rxn, getting longer as the rxn proceeds.

_____ $t_{1/2}$ varies during a rxn, getting shorter as the rxn proceeds.

_____ For a given rxn, two scientists will get different $t_{1/2}$ values experimentally if they use different initial concentrations.

_____ For a given rxn, two scientists will get the same $t_{1/2}$ value experimentally, regardless of initial concentration.

5. Which of the following data sets corresponds to a second order reaction?

A			**B**			**C**	
[A](M)	t (s)		[A](M)	t (s)		[A](M)	t (s)
100	0		100	0		100	0
50	10		50	10		50	10
25	20		25	30		25	15

6. It takes 30.0 min for the concentration of a reactant in a second order reaction to drop from 0.40 M to 0.30 M.
   a) What is the value of the rate constant for this reaction and its units?
   b) How long will it take for the concentration to drop from 0.40 M to 0.20 M?

7. For the first order reaction:

$$2N_2O_5 \rightarrow 4NO_2 + O_2$$

   a) If 20.0% of the initial N_2O_5 decomposes in 2.10 hr, what is the rate constant?
   b) What is the half-life of the reaction?
   c) If the initial concentration of N_2O_5 was 0.222 M, what concentration remains after 24 hr?

8. Hydrolysis of sucrose yields the simple sugars glucose and fructose:

$$\text{sucrose} + H_2O \rightarrow \text{glucose} + \text{fructose}$$

   The rate follows the rate equation: Rate = k[sucrose] and has a half-life of 3.3×10^5 s.
   If the initial concentration of sucrose is 0.10 M, what will be the concentration of sucrose after 24 hours?

9. Consider the reaction of hydrogen with iodine:

$$H_2 + I_2 \rightarrow 2HI$$

   This reaction has rate constants of 1.41×10^{-5} $M^{-1}s^{-1}$ at 393°C and 1.40×10^{-4} $M^{-1}s^{-1}$ at 443°C.
   What is the activation energy for this reaction?